

I. Recruitment of doctoral candidates

Country	1. Which institutions have the right to grant a doctorate?	2. Which entity inside the institution takes responsibility for the quality and for the scholarly evaluation of the dissertations?	3. Who plays the key role in the recruitment process? (e.g. individual professor, committee, tutor)
Germany	Faculties of (research) universities; Universities of Applied Sciences (FHs) are not entitled to grant the doctorate.	Each PhD candidate has his/her own Examination Committee, consisting of at least two Professors, and controlled by faculty council. During the doctoral phase, the supervising professor controls quality of work.	The individual professor ("doctor father" or "doctor parent"), supported by the standing doctoral committee
Netherlands	Universities	Rector + College of Deans	individual professor
Belgium	Universities	Each PhD researcher has his/her own Examination Committee, who evaluate the docotoral dissertation.	The individual professor, supported by the doctoral school
Denmark	Universities	The Phd Scoool has the overall responsibility as an entity but formal responsibility is delegated to the dean. The supervisor makes an internal assessment before a formal assessment committee is formed with external majority. The PhD Study Director acts on behalf of the dean. The director reviews all final assessments and a written statement from the supervisor write. Fulfilment of the different parts required for a PhD study.	Prior to the assessment the department and the project owner do a search among relevant network. An assessment committee (minimum associate professor level) reviews all candidates. A written statement is formed and an interview conducted. Based on these a recommendation is made to the Dean and PhD Study Director for final decision

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Turkey	Only universities	Graduate School for Science and Engineering	Applications are accepted via an open call; but individual professors recruit in parallel.
United Kingdom	Only by Universities with Research Degree Awarding Powers (Privy Council)		Professor plus school and University
Italy	Universities	Board of doctoral degree of teachers	Exam, Committee (Jury)
France	Universities and Grandes Ecoles	Doctoral School	professor and committee
Portugal	Universities	Scientific Council	Individual professor
Poland	University Faculties and Research Institutes have the right, given by the Ministry, to grant a doctorate in the research discipline(s), amongst some 25 disciplines specified by the Ministry. To obtain this right, four professors (PhD+habilitation) representing the discipline have to be employed.	Faculty opens doctoral studies and takes full responsibility for the quality and for the scholarly evaluation of the dissertations.	Individual professors, supervisors of MSc thesis, play the key role in the recruitment process . Most of candidates are own second cycle (MSc) graduates enrolled for the full-time doctoral studies.
Spain	Universities	The Doctoral School. Three external reports are requested previous to fix an Examination Committee, consisting of at least 3 Professors, from which at maximum only one of them may coincide with some of the ones that have done the external evaluation, the supervising professor controls quality of work.	Individual professors, Master Professors and interested students by themselves

(Recruitment of doctoral candidates; ctd.)

Country	4. In how far is the information concerning a future recruiting accessible (e.g. public advertising or hidden process)?	5. Who takes formally the final decision in the recruitment?	6. Can first cycle graduates enter doctoral programs? Or only second cycle graduates?
Germany	Vacant positions must be posted publicly. Process of publication is in the responsibility of doctor parent. Direct recruitment may also be done.	Doctor parent, controlled by the standing doctoral committee, who is entiteled to impose conditions, e.g. that necessary competencies or fulfillment of financial conditions must be verified within a given time.	From a legal point of view, first cycle candidates are permitted to enter the doctoral phase without having a second cycle degree. However, final decision is subject to furnished proof of defined competencies. In most faculties of engineering, an excellent Master's degree is the prerequisite.
Netherlands	varies - in general publicly advertised	professor; but admission to the defense is separate	Possible (foreign students with BSc + Honours; professional bachelors + relevant work experience)
Belgium	All vacant PhD positions are accessible on the KU Leuven website, but promoters still have the possibility to hire PhD students without a public vacancy	The professor selects the best applicant for his vacant PhD position. The applicant requests academic admission to the doctoral programme. The Faculty Doctoral Committee evaluates the personal file of the applicant and decides about admission to the doctoral programme.	What is meant by first cycle graduates? If the Bachelor cycle is meant by this, then the answer is, in principle, no. At KU Leuven a relevant master diploma with excellent grades is a formal requirement for admission to the doctoral programme. However, students who have followed a Ba program of 4 years and have relevant additional experience can be considered.

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Denmark	In general public advertising is made via the university website. In some cases also international sites or scientific magazines are used for advertising.	PhD Study Director and Dean.	At present only second cycle students (completed). It is some places possible to start during second cycle.
Turkey	Professors' advertisement varies with the availability of funding, project cycles, etc. Otherwise, programs admit doctoral students via open calls on the academic year cycle.	Successful candidates fulfilling the Intercollegiate Council's principles and the individual institution's requirements may be further screened for references, etc. or interviewed by the program's admission committee.	They can, with a GPA greater than 3.0/4.0.
United Kingdom	Publically advertised		Normally only second cycle candidates, exceptionally first cycle
Italy	Public advertising/tender	Examination Committee	Only 2nd Cycle graduates
France	Usually, public advertising	The president of the Director of the Institution	Second cycle. However some LLL can be applied
Portugal	Public advertising	Most frequently the scientific council	Second cycle graduates; first cycle only in very special conditions (very relevant scientific curriculum)
Poland	The information concerning a future recruiting is publicly accessible through dedicated web site, for both full-time and part-time studies.	The final decision in the recruitment is formally taken by the Rector, based on recommendation of the Faculty Recruitment Committee.	Only second cycle graduates (MSc) may enter doctoral studies.
Spain	varies - in general publicly advertised	After student's PhD proposal, comments are done by Doctor Tutor or PhD Director. Afer the approval of any of these, the PhD Committee of the Department is to approve it.	Only Master graduates

(Recruitment of doctoral candidates; ctd.)

Country	7. When and by whom is the research topic specified, what is the flexibility for adaptations/modifications during the process?	8. What are the typical formats of funding?	9. How long is a typical commitment of funding at the start of the doctoral research?
Germany	A coarse specification of the planned research topic is agreed upon by the doctor parent and the candidate. Doctor parent decides on "doctorability" of the topic. Since a doctoral thesis must cover autonomous research work, the actual topic of the doctoral thesis evolves and may be re-specified depending on the results of research work. If the candidate is financed by a dedicated project, flexibility is limited to the purpose of the project.	<ol style="list-style-type: none"> 1. Employment as a research assistant of the university, funded by the state. 2. Third-party funding e. g. by EU, or from research organisations, or industry. 3. Grants from various organisations. 	Depends on type of funding: one year, two years, or three years, with a possible prolongation to a maximum of five years. However, if commitment for the funding at the start of the doctorate phase is shorter than 3 years, it is obvious that some prolongation will become necessary.
Netherlands	Promotor (= supervising professor)	Funding organisation; Industry, Foreign	4 years; international funds sometimes 3

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<p>Belgium</p>	<p>For the largest part, the professor decides about the topic of the PhD research. In some cases the PhD researcher him/herself can deliver some input. Minor changes (e.g. scope) are possible throughout the PhD, but a major change of topic is not possible (in other words: that would be considered as stopping the previous PhD research and starting up a new PhD research). Some financing types do not allow much flexibility with regard to the topic of the research.</p>	<p>Most PhD researchers are funded through a PhD scholarship. (either a personal scholarship through an external (mostly government) funding agency or a university scholarship). Most other PhD researchers receive a salary.</p>	<p>The aim is to complete a PhD in four years. Most funding types consist of yearly commitments, some are 2 years + 2 years.</p>
<p>Denmark</p>	<p>In most cases the topics are defined by the supervisor. However, there are also examples where the project is jointly defined by the supervisor and student. A study plan describing the project must be approved latest three months from start. An updated version is delivered after eleven months from start and may include an adjusted project description.</p>	<p>Fully financed, co-financed (industry/university or similar) or tuition waiver.</p>	<p>Three years as a full time study.</p>

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<p>Turkey</p>	<p>The research topic is mainly specified by the professor. The decision may be influenced by his or her involvement in funded projects, publication plans, or simply the next frontier in their area of expertise.</p>	<p>TÜBİTAK: The Scientific and Technological Research Council of Turkey has many programs of funding for research and development projects that doctoral candidates can be supported on, or doctoral dissertations directly, or other activities such as conference participation, etc.</p> <p>All R&D funding that universities are entitled to, such as those from the State Planning Agency, Ministry of Science, Industry and Technology, Ministry of Transport Maritime, Affairs and Communications, provide means for doctoral students. There are private foundations supporting education that offer scholarships and stipends.</p> <p>Industry will typically fund relevant doctoral work, of their employees or students working on their funded research and development projects.</p> <p>Universities themselves will hire doctoral candidates as teaching or research assistants and provide them with scholarships and stipends. Doctoral students of engineering typically do not pay</p>	<p>Depending on the source of funding, timespan of commitment varies: state-sponsored projects may have a two to three year horizon while industrial grants are typically no longer than a year. Other than the funding from the university, all are subject to conditions for renewal at preset reviews.</p>
<p>United Kingdom</p>	<p>Research topic provisional and modified</p>	<p>either research councils, industrial, or University or private</p>	
<p>Italy</p>	<p>Initial proposal by the candidate; tutor/s' advisory; final decision approved by the board of teachers. Adaptation are possible within the first 2 years.</p>	<p>Scholarships; additional funding for mobility</p>	<p>3 years</p>

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France	The topic is proposed by the professor and validated by the director of the laboratory	The funding is split in two ways. The salary of the Phd student and the cost of the research. When the salary is ensured, usually the lab finds the additional costs.	Three full years. A director of doctoral school can block the recruitment, if means for funding are limited.
Portugal	After 1st year by tutor; flexible	Tuitions; Research grants	Three years
Poland	The research topic is specified by the student and his/her tutor - high flexibility for adaptations and modifications during the Stage 1 (before opening the PhD procedure), including changing of the tutor, is in force.	Ministry funds and numerous grants (EU and national) are available for covering costs of doctoral studies and scholarships, for both full-time and part-time students. Final stage (supervisor's and reviewer's fee) is financed by: 1. the Faculty, for full-time students, 2. candidate or his/her employer, for part-time students.	The doctoral studies are 4-year studies. Full-time studies may be extended, in exceptional cases, by one year.
Spain	In most cases the topics are defined by the supervisor. However, there are also examples where the project is jointly defined by the supervisor and student. A study plan describing the project must be approved within 6 months from start. Later it may be changed with the Commission approval	Not standard financing. Some students get grants from the state, the Regional Government or EU. Others get no financing at all.	Depends on type of funding: one year or two years with possible yearly prolongations.

(Recruitment of doctoral candidates; ctd.)

Country	10. Is there a limitation on the maximum number of doctoral candidates an academic can supervise simultaneously?	11. Are there currently key issues under discussion in your country concerning the recruitment?	12. What is likely to change in future?
Germany	Not an official one, yet.	Gender issues may get more important with respect to the low percentage of female engineers.	Limitation on the maximum number of doctoral candidates per professor. It is furthermore discussed to demand formal achievement rather than non-formal achievement of additional, non-research-oriented skills that may be achieved in specialised courses, preferably offered by centralised academic organisations. Cooperation between (research) universities and universities of applied sciences is to be intensified in order to facilitate admission to a doctoral programme for graduates of univ. appl.
Netherlands	No	Scholarship-based positions for National candidates (traditionally our PhD students are employed)	Duration; increased scholarship-funding

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Belgium	There is no formal maximum amount, but there is a university guideline which states that a professor should only supervise the number of PhD researchers he/she can provide sufficient guidance for. In most cases PhD researchers are guided by more than one supervisor (e.g. professor and a postdoc).	There are currently no concrete points being discussed at the political level.	It is possible that public advertisement of every PhD position will become mandatory.
Denmark	This is assessed by the PhD Study Director on an individual basis. Co-supervisors are encouraged and sometimes demanded.	Not currently.	Continued Increase in the number of enrolled students.

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Turkey	No.	Turkey has suffered from “brain drain” in engineering where top graduates from Turkish universities have aspired to, and have been encouraged to, do their graduate work abroad; in the USA and Western Europe and Japan since 1960s. Even though efforts to reverse brain drain have proven successful in recruiting researchers back into Turkey, this entails bringing back those with a foreign PhD degree. “International experience” is one of the hiring preferences for PhDs in engineering, and PhD degrees from few universities in Turkey provide the same aura on one’s resume. There are other issues such as the ever present dilemma of higher paying work versus the low-pay research assistantship and doctoral studies. For male candidates, being an enrolled student is an excuse to delay military service; this may come in as a primary motivation to be registered in a doctoral program with little research	Mobility programs, joint degrees, international research collaborations (fueled by reverse brain drain) have started to change the implicit but rigid preference for “PhD abroad.” In terms of content, there is growing emphasis on empirical or applied research in engineering.
United Kingdom	Number of candidates per staff limited		
Italy	There is no legal limitation	1) accreditation 2) attractiveness 3) language 4) internationalisation 5) external funding	Consortia of Universities
France	Yes. This depends of the field and of the institution (local rules). In average , three equivalent full time	Yes, depending of the field	In engineering, the number of student is decreasing. The rules must be adapted, more especially to recruit foreign students (out of E.U.) with different curricula and diploma

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Portugal	Not in general, although it exists at some universities	a) Doctorates should be allowed only in universities or also in polytechnics? b) What should be more important to grant a doctorate? Type of institution (university/polytechnic; public/private) or quality of the institution	No changes expected in near future
Poland	The maximum number of doctoral candidates an academic can supervise simultaneously is limited to 10. This limitation has no practical meaning in Poland, due to lack candidates.		
Spain	No	Not currently.	No changes expected in near future

II. Status of the main groups of doctoral candidates

Country	1. What is the formal status of doctoral candidates of e.g. students, holders of scholarship, or employees for research of the university?	2. What is the percentaged amount of time, the doctoral candidate may use for his/her doctoral research in different formats, e.g. of candidates in structured doctorates, "assistant" doctorates, external research in industry?	3. To what extent are doctoral candidates involved in teaching?
Germany	<p>Most doctoral candidates for engineering are employees for research and/or education at universities, financed either by the state or by third-party money (so-called research assistants). There are also candidates that are financed by scholarships. Some candidates are employees in industry (external doctoral candidates), they are supervised by a university professor. Non-employed candidates may apply for the status of a student.</p>	<p>Employed assistants work formally 50% of their contract time for research purposes. University assistants financed by industry work for a larger amount of time for research. Structuring of the program for employed doctoral candidates is given by their duties as team-leaders, project-reporters, and teaching assistants. External candidates must have an agreement with their employers, otherwise they must use their spent time for research. Candidates with a scholarship may theoretically work 100% of their time for research. However, they are usually involved in an educational program that structures their time schedule (structured doctorates).</p>	<p>This depends strongly on the individual case: University funded positions are usually assigned to teaching duties of 3 - 6 hours per week during lecture time, while industry funded doctoral candidates mostly only teach to acquire the respective additional skills.</p>

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Netherlands	employee	90 - 100%	Teaching assistance is customary and recommended
Belgium	All PhD researchers at the university have student status. A large part of them also have employee status (namely, when the financing (either scholarship or salary) is through the university).	There is no formal percentaged amount of time set.	All PhD researchers are expected to do a substantial contribution to teaching. The amount varies.
Denmark	Depends on the type of enrollment. Holders of a stipend are employed staff members; tuition waivers are not employed.	For three programs it is a full time study. If the work percentage is lower the time duration of the PhD project is adjusted accordingly.	By law any doctoral candidate must perform dissemination of research and scientific work. In some cases the amount of teaching may be up to 732 hours during the 3 year program but in other cases this is significantly lower depending on scientific area.

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Turkey	From the point of view of the university, the doctoral candidate has to be a full or part time student, with or without employment elsewhere. Candidates may receive scholarships from a multiplicity of sources. The candidate may also be an employee of the university as a teaching or research assistant.	During coursework, the amount of time the doctoral candidate spends on his or her research varies. After the coursework is completed, the full time student is expected to allocate 60, 80, or 100 % of their time to their research depending on their employment with the university; teaching assistant, university-employed research assistant, or externally funded research assistant. Part time students, e.g., those on an external research appointment with the industry, work out agreements with their professors on a doctoral study schedule. In practice, individual cases vary greatly as the checkpoints and associated sanctions are few and far in between, up until the total timespan restrictions on funding (there is no time limit to student status).	As teaching assistants, doctoral candidates in engineering can supervise undergraduate laboratories, coordinate problem sessions, and aid the professors in grading, proctoring, data entry, etc. Teaching assistants are understood to be part time employees; i.e., these activities are planned to take up no more than 50 % of the candidate's time.
United Kingdom	Can be either students or early career researchers or members of staff; PhD's not credit rated ProfDocs maybe		Normally involved in teaching as assistants
Italy	Holders of scholarship	About 120 credits out of 180	Very little
France	The PhD students are considered mainly as employees of the institution, except if the student is directly paid by a research organism or a company	The PhD student must work 1607 hours per year. This is the legal duration of workers. However, it is not enough to prepare a good thesis.	For teaching, there are specific "missions". The PhD student may teach in the institution 64 hours per year. No more. He receives an extra on his/her salary
Portugal	Students	80%	Possible, but not frequent

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Poland	Student, holder of scholarship is the most common formal status of doctoral candidate. Employee for research of the university is the option.	It is difficult to generally evaluate the percentages amount of time, the doctoral candidate may use for his/her doctoral research in different formats. Generally, this time is close to 90% for full-time students.	Full-time doctoral students, holders of scholarship are involved in teaching, as regular academic teachers: 90 h/year. Other students are involved in teaching practice: 10 or 30 h/year for part-time and full-time respectively.
Spain	Doctorate students	If full time as doctorate student during a maximum of 3 years. Otherwise as part time doctorate student during a maximum of 5 years.	Just practical classes if they get a scholarship of type "FPI", i.e. as "Research Fellow Training".

(Status of the main groups of doctorate candidates; ctd.)

Country	4. Is membership of Graduate Schools mandatory?	5. Is there a mandatory participation in accompanying taught courses or in other types of additional program? If yes: Who selects the topics (e.g. committee, supervisor, candidate, Graduate School)? If yes: How many credits/ which workload is linked to these elements?	6. What are typical salaries/scholarships of doctoral candidates compared to young professionals in industry?
Germany	At a few faculties only.	If doctoral candidates are members of a graduate school, they must attend accompanying courses, which are chosen by the doctoral candidates in agreement with their supervisors. The total workload depends on the faculty. Its ECTS-equivalent may vary between 2 and 15 ECTS.	Salaries for university employees are comparable to or a bit lower than that of an average engineer in a beginner's position. However, industry salaries may be considerably higher, depending on negotiations. Scholarships are lower than the full-time net-salaries, usually about 20% to 30% lower.
Netherlands	No; but is under consideration	Yes; agreed with promotor	typically just under industrial start level

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Belgium	Yes, each doctoral candidate needs to be registered at one of the three doctoral schools at KU Leuven	The doctoral candidate does not need to acquire official ECTS credits, but we use ECTS credits as a measure to count the amount of time that needs to spend in formal training. In Arenberg Doctoral School, each doctoral candidate needs to follow an equivalent of 6 ECTS credits of formal training, of which at least 2 need to be generic skills training. The doctoral candidate makes a proposal in agreement with his/her supervisor and the Faculty Doctoral Committee approves the proposal. There is a very large flexibility with regard to the kind of training. There are no generic tracks.	The scholarship amount in KU Leuven is very reasonable (about 1.800 euro netto per month). This is comparable to salaries of young professionals in industry (they might earn somewhat more but nevertheless).
Denmark	Yes.	Yes - 30 ECTS courses must be followed covering both general and project relevant courses. The Doctoral School offers a large amount of courses to choose from. The doctoral candidate and supervisor proposes a selection of courses which must be approved by the programme leader. The guidelines for types of courses etc. are settled by the PhD board and the PhD Study Director.	The salary is decided by government. In technology and science the salary is often significantly lower than in industry - it does vary significantly, however.

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Turkey	If we mean enrollment in graduate school by "membership," yes, all graduate programs; masters and doctoral, are administered by the graduate school.	Yes. Program-specific curricula are prescribed by the university. Typically there are many electives at the doctoral level, so the professor may lead the student in choice of courses to take. The number of credits; in fact, the overall curriculum is prescribed by the university, subject to Intercollegiate Council's approval. The number varies between 20-30 ECTS. For students with a master's degree in a relevant field, some of this coursework is waived.	Depending on the sector, the stipend is anywhere from 75 % to 25 % of the industry's offers. The status of doctoral candidates at state versus private universities also vary somewhat.
United Kingdom	Normally members of Graduate Schools	Some element of taught courses usual	
Italy	Yes	Yes	Nowdays about 50 to 70%
France	Yes	Yes. A menu is proposed to the student with different kinds of complementary courses (technical, general culture, summer	The salaries are in average 30% lower
Portugal	No	Yes; Graduate School; 30 credits	Similar
Poland	Membership of Graduate Schools is mandatory.	Doctoral students participate in regular courses: 60 ECTS/year. Participation in accompanying taught courses is not obligatory - subject of the supervisor's recommendation.	Typical scholarships of full-time doctoral students compared to young professionals in industry is typically less than 25-50% - subject to character of the scholarship and profession.
Spain	Yes	A minimum of Transversal courses should be followed	Slightly silimar when there is such a grant

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(Status of the main groups of doctorate candidates; ctd.)

Country	7. What is the social security status of candidates referring health care?	8. What is the social security status of candidates concerning pension funds?	9. Which key issues are under discussion in your country concerning the status of doctoral candidates?
Germany	Health insurance is mandatory for everybody; for employees, the usual legal regulations apply.	For employees, the usual legal regulations apply. For holders of scholarships, there is no participation in pension funds during this time. It is a qualifying period, however, for later computation of retirement pension.	None, at the moment.
Netherlands	same as employee; but there are scholars as well	employee entitled to pension plan	change to student status with scholarship
Belgium	PhD researchers with a scholarship pay social security contributions, he/she is regarded as an entitled employee for health insurance purposes.	With regard to the pension, the PhD scholarship periods subject to full social contributions are regarded as time worked.	
Denmark	Covered by national healthcare.	Employed doctoral candidates with a stipend receive selectable pension.	None.
Turkey	Turkish labor law dictates health insurance to be provided by the employer. Doctoral candidates, even when on scholarships, are considered employees if their projects are specified (i.e., expected work is written down).	Social security benefits are included in employment.	Salary and benefits such as housing and transportation aid cannot be overdone, especially in Istanbul.
United Kingdom			
Italy	Health care secured is for all citizens	It is up to every single person	Student/scholar vs research employee: open debate

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France	The students are now considered as workers with healthcare	The students are now considered as workers (participation tho the funding of their future pension)	The problem is to find resources other than those coming directly from the Ministry of Higher Education. The number of grants is decreasing each year by about 10%.
Portugal	Same as general population on a voluntary base	Same as general population on a voluntary base	No issues
Poland	Social security status referring health care of full-time doctorate students is the same as status of other students.	Social security status concerning pension funds of full-time doctorate students is the same as status of other students (non-contributory period). However, pension funds do not count if PhD is not obtained within 5 years of studies.	
Spain	Social security as Doctorate student	No pension funds	None specially. The concern of having it duly recognized outside academic world

(Status of the main groups of doctorate candidates; ctd.)

Country	10. What is likely to change in future?		
Germany	-		
Netherlands	More diverse inflow; differentiation in status; stricter supervision requirements and more rules for supervisors		
Belgium			
Denmark	No changes are reported for implementation at this current time.		
Turkey	<p>University-industry collaborations are strengthening, which has introduced a favorable trend of sponsored PhDs with shared appointments and increased mutual understanding of different needs and priorities. More applied research seems to be emphasized with this trend.</p> <p>International students are increasing in numbers: better salaries to attract the best out of a bigger playing field and more competition to get these places are expected to result in overall betterment of doctoral studies.</p>		
United Kingdom			
Italy	For the moment not provided		

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France	We have too many ways to get funding. The professors and laboratories must spend a lot of time to obtain the grants. A national funding structure could save a lot of time that could be devoted to research activities.		
Portugal			
Poland			
Spain	No big changes foreseen		

III. Format of the Doctorate

Country	1. Who is responsible for the supervision of the doctoral candidate and how is it organized?	2. Is there are formal supervision agreement? When is it established? Who signs?	3. Is there an additional quality control (e.g. by a committee, a 2nd supervisor, a mentor)?
Germany	<p>The doctor parent. Also, organisation of supervision is in the duty of the doctor parent. It is customary that doctoral candidates present their progresses on a regular basis (every week or fourtnight) to the supervisor. A university internal public presentation of progresses is usually done once a half year.</p>	<p>Formal supervision agreements are not yet mandatory, but the are introduced at more and more faculties. They are established at the beginning of the doctoral phase, and they are signed by both, the doctor parent and the doctoral candidate.</p>	<p>Though not yet compulsory, 2nd supervisors or mentors are common in more and more faculties of engineering. They accompany the complete doctoral phase. For evaluation of the doctoral thesis, at least one second reviewer is mandatory, who must be a professor at a (research) university, perferably from another university. There is a public defense of the thesis and a final decision of an examination committee, the members of which are professors, and that will be controlled by the standing</p>
Netherlands	<p>Promotor = supervising professor, usually assisted by Associate of assistant prof.</p>	<p>Education and Supervision Plan is mandatory</p>	<p>PhD committee with independent members</p>
Belgium	<p>Each doctoral researcher has a (personal) supervisory committee, consisting of a supervisor; zero, one or more co-supervisors; and at least 2 other experts in the field. Each year during the PhD, the PhD researcher either needs to give an oral presentation to his/her supervisory committee; or needs to submit a written progress report to his/her supervisory committee.</p>	<p>No, there is not.</p>	<p>Each doctoral researcher has a (personal) supervisory committee, consisting of a supervisor; zero, one or more co-supervisors; and at least 2 other experts in the field. Each year during the PhD, the PhD researcher either needs to give an oral presentation to his/her supervisory committee; or needs to submit a written progress report to his/her supervisory committee.</p>

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Denmark	Associate professors or professors are responsible for the supervision of doctoral candidates. The supervisor and doctoral candidates are parts of research groups with the doctoral candidate fully integrated in this. The PhD Study Director is overall responsible for the supervision and has the authority to change supervisors and other things if necessary. Supervisors are appointed by the PhD Study Director as stipulated in the Ministerial Order for PhD education.	Yes. The agreement is part of the study plan where the conditions for supervision is agreed by the doctoral candidate and supervisor. Both the supervisor and doctoral candidate signs as well as the leader of the doctoral programme once the study plan is accepted.	The program leader approves the study plans. Also the supervisors are obliged to hand in a status sheet every six months regarding scientific level and progress. If required the PhD Study Director acts on these. One possibility is to initiate a three months reestablishment plan if the studies are not progressing as expected in the study plan. Such a request is formulated by the supervisor and finally decided by the PhD Study Director.
Turkey	Supervisors need to be academic track researchers; assistant professor, associate professor, or professor. Other research associates and teaching staff may not supervise doctoral work. Supervisors are paired with students at the time of recruitment; or the student may approach the supervisor of their choice. Full professors seem to be better able to attract doctoral candidates due to their established credentials and reputation in the field, e.g., ties with the industry or number of publications tend to be stronger. Younger faculty may recruit candidates by advertising new/interdisciplinary frontiers that are especially appealing if they are also topics of their funded projects.	After the coursework is completed, at the time the dissertation topic is selected, the doctoral committee is formed. The committee includes the supervisor as the head. Depending on the university's rules, an external member may be mandatory. Depending on the work, a co-supervisor (may be external) is also possible.	The doctoral committee meets every 6 months to a year first to approve the topic and scope and general plans, and in subsequent meetings, to monitor the progress. Revisions, course corrections, changes are prescribed by the committee. Finally, the committee votes to decide on graduating the candidate at the defense, provided there are only minor changes required.
United Kingdom			Second supervisors mandatory
Italy	1 or 2 tutors intermediate reports	Tutor is assigned by the board of teachers	Quality assesment is done collegially

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France	The professor and his/her assistant professor. This "assistant" can be an industrial	Yes, a convention is signed by the supervisor, the co-supervisors, the student and the director of the doctoral studies. (Doctoral school)	A committee evaluates the progression of the research work each year .
Portugal	Tutor appointed by scientific council	No	Frequently yes, by a committee
Poland	<p>To formally start the process, recommendation of the Faculty Committee for Doctoral Studies is necessary. The recommendation is given based on publications, their number and quality. The Faculty Board (professors with habilitation) adopts the following resolutions:</p> <ol style="list-style-type: none"> 1. Opening of the Doctorate, acceptance of ...its plan and title; 2. Assignment of the supervisor, formertutor of the candidate; 3. Assignment of doctoral examinations and ...examination committee - 3 exams: <ul style="list-style-type: none"> ...3a. main exam for the discipline, ...3b. exam related with the topic,3c. English language; 4. Assignment of the doctoral jury. 	Following the Faculty Board resolutions, the supervisor and the student are formally informed by the Dean.	Optionally, the 2nd supervisor may be assigned by the Faculty Board.

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Spain	The Doctorate Tutor or Director	After student's PhD proposal, comments are done by Doctor Tutor or PhD Director. After the approval of any of these, the PhD Committee of the Doctorate School is to approve it.	There is an annual report submitted to the Doctoral Commision Board. At least three independent reviews have to be received. In some universities 5 independent reviews are required. Before appointinting the Board to judge it. Usually this Board has so many members as external reviews and at least two of its members must be different from the external reviewers.
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(Format of the Doctorate ; ctd.)

Country	4. Are there formal evaluations at milestones during the doctoral process (e.g. each 12 months)? By whom?	5. Is it mandatory to keep records of the supervision meetings?	6. Is doctoral research possible outside a research environment without being involved in a group of several fellow researchers? Can you list the different formats (e.g. non-university research organization, industry, etc.)?
Germany	Not standardised.	Not standardised.	External doctorates are usually not accepted, if there is not a suitable research environment. The supervisor must be a professor at a university, anyway.
Netherlands	once per year; go/no-go after 1 year	Yes, administrated by HRM department	Yes, all are possible
Belgium	Within 3 months of the start of the PhD, the PhD researcher needs to submit a blueprint for the formal doctoral training he/she will follow throughout his/her PhD. Within 9 months of the start of the PhD, the PhD researcher needs to give an oral presentation to his/her supervisory committee. This is an important formal evaluation. Within 21 months of the start of the PhD, the PhD researcher needs to submit a written progress report to his/her supervisory committee. Within 36 months of the start of the PhD, the PhD researcher needs to give a second oral presentation to his/her supervisory committee focusing on the time plan to finish the PhD.	The report of the meetings with the supervisory committee are included in the PhD researcher's personal file.	The IWT (a national funding agency) provides funding for PhD's in co-operation with industry, called 'Baekeland'. Doctoral candidates who have a supervisor in university and a supervisory in industry can apply for this type of financing (highly competitive). The PhD researcher can either perform the research at the university, in industry or combining stays at the university with stays in industry. However, the PhD researcher will need to be embedded in the university research group (give at least 2 seminars, follow formal doctoral training) and is supervised by the academic and the non-academic supervisor, so the PhD researcher is not isolated.

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Denmark	Every six months the supervisor must make a report for the Doctoral School regarding progress and quality of PhD work. In case of problems the PhD Study Director is involved.	No.	It is a possibility for the doctoral candidate to stay at a different research institution for up to six months. This includes both university and industry.
Turkey	The doctoral committee meets every 6 months to a year first to approve the topic and scope and general plans, and in subsequent meetings, to monitor the progress. Revisions, course corrections, changes are prescribed by the committee. Finally, the committee votes to decide on graduating the candidate at the defense, provided there are only minor changes required.	Yes. The minutes are submitted to the graduate school.	No, only universities in Turkey may confer doctoral degrees.
United Kingdom	Formal annual milestones with records		Doctoral research can be either in Doctoral Training Centres (DTC's) or not
Italy	Every 6 months; plenary meetings	Yes	Not normally
France	Yes. Once a year by the Committee of Thesis"	No.	Yes. But the supervisor must be a member of the institution. Some exception exists with research organisms such CEA.
Portugal	Frequently yes, by a committee	No	It's possible, namely in industries, but not frequent
Poland	There are formal evaluations at milestones during the doctoral process, each 12 months, by the Faculty Committee for Doctoral Studies.	It is not mandatory to keep records of meetings with the tutor/supervisor.	In exceptional case, the doctoral research is possible outside a research environment without being involved in a group of several fellow researchers, e.g. in non-university research organization, industry, etc.
Spain	There is no formal exam in each annual report.	Yes, a written record must be kept.	External doctorates are not usually accepted.

(Format of the Doctorate ; ctd.)

Country	7. How is the link of the granting institution established and maintained for external doctoral candidates?	8. Can you briefly describe the different formats and letter of awards for doctorates?	9. Are there cumulative dissertations or other formats without a monographic representation of the doctoral candidate's individual contribution?
Germany	Usually, there is a contract between the granting institution or company with the university represented by the supervising professor. In most cases, this requests status reviews on a regular basis.	There is a certificate stating the topic and the grade. Grades are "Doctor of engineering", "Doctor of natural sciences", depending on university faculty	In most cases, monographic dissertations are required. Not all engineering faculties do exclude cumulative dissertations, though these are seen as substandard by the majority of colleagues.
Netherlands	via promotor and usually (mutual) visits	Formal Diploma	Dissertation is the standard; it may concern a Design, but still has to be documented in a thesis
Belgium		The PhD thesis consists of an introduction, chapters and a conclusion. Each chapter can be either original text; or a text which has been submitted/accepted for publication.	The PhD thesis consists of an introduction, chapters and a conclusion. Each chapter can be either original text; or a text which has been submitted/accepted for publication.
Denmark	(Question not clear.)		
Turkey	All doctoral candidates are enrolled students of the university, whether they are full or part time.		The dissertation is typically a collection of publishable chapters; a survey as the introduction and an overarching conclusion and future work chapter at the end. Sometimes when it is a combination of theoretical and empirical or computational work complementing each other, each effort is dedicated a chapter on its own, or the work is divided vertically into chapters, e.g., each theoretical contribution vetted by simulations, etc.

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United Kingdom			
Italy		The PhD degree is awarded by means of a Diploma	No.
France	A common agreement is mandatory	For recruiting a PhD student, it is mandatory to mention some prerequisite in research. Usually, some intership in a republic or private research lab fulfils the mandatory conditions.	No.
Portugal	NA		It is possible to have a dissertation composed by the compilation, properly framed, of coherent and relevant research, already subject to publication in journals with internationally recognized selection committees
Poland	External co-tutor is normally assigned as a link between granting institution established and maintained for external doctoral candidate.	The letter of award for doctorates is standardized	There are no cumulative dissertations or other formats without a monographic representation of the doctoral candidate's individual contribution
Spain	NA	An official awars as Doctor is received	It is possible to have a dissertation composed by the compilation, properly framed, of coherent and relevant research, already subject to publication in journals with internationally recognized selection committees

(Format of the Doctorate ; ctd.)

Country	10. Is it mandatory to publish the dissertation such that results are accessible for scholarly and public review? Are exceptions from that procedure possible and if yes under which circumstances?	11. Are intermediate publications allowed or even mandatory before completing the dissertation?	12. Is there a final oral examination (defense)? Who participates during the defense? Is the supervisor an examiner?
Germany	Publication is mandatory.	Yes, they are not only allowed, but even highly recommended.	Yes, there is a public defense. Typically, three or even more examiners participate. The supervisor is one of the examiners. Usually, parts of the examination are public, parts are behind closed doors.
Netherlands	Yes, every PhD thesis has to be publicly available	Allowed, encouraged but not mandatory	Defense for a committee of mostly independent opponents, and the supervisors

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Belgium	Each PhD researcher is required to submit an electronic version of his/her doctoral thesis to the university's depository. In agreement with his/her supervisor, the PhD researcher can decide to make the doctoral thesis fully accessible; only accessible to university members; or not accessible for a limited amount of time.	The PhD researcher needs to be main author of at least one accepted international peer-reviewed publication before he/she is admitted to the PhD defence.	The final examination consists of 2 parts. First there is a preliminary defence: the PhD researcher presents his/her work to the full examination committee (including supervisor) behind closed doors. There is a thorough discussion and afterwards the examination committee (including the supervisor) decide if the PhD manuscript is accepted; is accepted with minor changes; needs to be revised and if the PhD researcher is allowed to publicly defend his/her PhD. When the manuscript is accepted by the examination committee, the PhD researcher is allowed to publicly defend his/her PhD. This defence has a more ceremonial function.
Denmark	It is mandatory to publish for public review.	It is allowed and encouraged but not mandatory.	Yes. The assessment committee comprising three members (minimum two external to the university) asks questions to the doctoral candidate. The defense is part of the overall assessment. The supervisor is not part of the assessment committee but follows its work with no voting rights
Turkey	All dissertations are archived by the Higher Education Council of Turkey and are accessible on their web page.	Most competitive universities have rules deeming journal publications a mandatory requirement for graduation with the doctoral degree. The number and merit of publications (conference, journal, journal ranking, conference acceptance rate...) are university-specific.	The supervisor is a non-voting member of the defense (doctoral) committee that gathers for the oral defense. Usually, doctoral defenses are open to public.
United Kingdom	Theses are published	Intermediate publications expected	Vivas are mandatory, supervisors not allowed to attend

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Italy	Yes.	Intermediate publications are allowed, but not on the original part of the dissertation	Of Course. There is an examinations jury, of which the supervisor is one of the members
France	Not mandatory. Usually, the thesis is public and found in libraries. However, some theses must be confidential. A derogation is established between the partners (usually with industry or research)	Yes. This depends of the field. A patent can be considered as a publication.	Yes. The defense is splitted in three parts : presentation of the work by the canddiate, questions of the jury, deliberation of the jury. (about 2.5 hours for the total in engineering)
Portugal	Yes; no exceptions	Intermediate publications are mandatory	Final oral examination before a jury (5 to 7) including supervisor
Poland	It is mandatory to publish the dissertation such that results are accessible for scholarly and public review. Exceptions from that procedure are possible, if the research is confidential, eg. military. The dissertation can be written in Polish or English.	No intermediate publications other than journal or conference papers are mandatory before completing the dissertation.	The final defence is oral and public, i.e. open to anyone that wants to participate. The announcement (web site, library board) has to be issued not later than 10 days before the date of defence. The candidate presents the dissertation. Then, answers questions related with the presented research. At first, the candidate answers the reviews, and next, questions asked by members of doctoral jury and other participants.
Spain	Publication is mandatory.	Yes, they are mandatory.	Yes, there is a public defense. Typically, three or 5 examiners participate. The supervisor cannot be one of the examiners. All theses must be presented. There is an oral interview after the presentation.

(Format of the Doctorate ; ctd.)

Country	13. What is the typical duration between start and defense for fulltime doctoral candidates respectively part-time ones?	14. Which key issues are under discussion in your country concerning the formats of Doctorates?	15. What is likely to change in future?
Germany	3 - 6 years.	All kinds of formats are under discussion. However, most faculties (as 4ING) endorse the assistant doctorate with autonomous research work and monographic dissertation, and participation in teaching.	It is expected that supervision will be subject to formal rules concerning rights and duties, for the supervisor, as well as for the doctoral candidate. Additionally, achievement of non-research oriented skills will be stronger formalised.
Netherlands	One hour; title awarded after brief deliberation of the committee	Shape of thesis - publications; printed or electronic; intermediate presentation to the committee after two years	Hard to say
Belgium	full-time PhD researchers are expected to complete the PhD in 4 years. Part-time PhD researchers have an individual timeline.		
Denmark	3.5 year full time study - 6 years for part time	4+4 agreement where a master degree student may be enrolled for doctoral studies in the last year of the masters education. Also other possibilities are discussed.	Not clear.
Turkey	Six years of total study is a limit to financial support of doctoral students. This includes the coursework. Full time students on the average spend 4 years in total, which is a timespan attainable by part time students although part times vary up to 8 or 9 years.	Uniformity of quality standards; such as publication requirements.	Open sourcing doctoral dissertations is likely to force quality for the better. Universities are slowly but surely adopting e-library and open resource philosophies, where doctoral dissertations are assigned university press reference numbers and are increasingly referable.

The different Engineering PhDs in Europe

United Kingdom	Typically 3-4 year duration full time or part time equivalent		
Italy	3 1/2 to 4 years	1) consortia 2) international (joined) degrees 3) external funding 4) accreditation	DM 45/13 has just been introduced
France	Ideally is 3 years (Bologna process). However, the effective duration is 3.4 years	The Ministry is not ready to change something, for the moment.	The problem comes at the end of the legal duration. Usually there is no more grant and the supervisor must find some financial support for several months. A complex procedure.
Portugal	3.5 years fo fulltime; NA for part-time	3.5 years fo fulltime; NA for part-time	How to adequately support Doctorates in industry
Poland	The typical duration between start and defence for full-time doctoral candidates respectively part-time ones is 3-4 years and 4-6 years.		
Spain	3 years for full time and 5 years for part time	Not at the moment	Unclear

IV. Outcome

Country	1. Define the five most expected skills and competencies expected upon completion of the doctoral phase	2. Are expected skills and competences defined in national or institutional frameworks? If yes, please provide the link.	3. Estimate the percentage of consecutive occupation of the candidates after doctorate in the categories a) science b) commerce and industry; c) governmental organizations and administration
Germany	<p>Doctors of Engineering must</p> <ol style="list-style-type: none"> 1. dispose of an excellent knowledge on rules and methods in several specialized fields of work or study, as the basis for own creative work to systematically develop novel methods, and, if indicated, to apply them to changed situations. 2. demonstrate autonomy and sustained commitment to the further development of new ideas or processes by scientific application of their competences to problems in novel contexts. 3. be able to circulate knowledge and ideas they have compiled and created, as it is demonstrated by writing a scientific dissertation and peer-reviewed publications, and by conducting disputations. 4. to guide and instruct less qualified members of their team, which includes a good understanding of knowledge and skills in this field of social competences. 5. be able to acquire financial and other means for bringing forward their work, which is another field of social competences. 	<p>Yes, at several locations, e.g. by 4ING at http://www.4ing-online.de/fileadmin/uploads/pdf/ThemenProjekte/GermanDoctorate_2012_04_16-v1.pdf</p>	<p>a) 5-10% b) 80% c) 10-5%</p>

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Netherlands	Independence; scientific/academic level of action and thoughts; effective communication; understanding of context	No	10-70-20
Belgium	The PhD researcher must be main author of at least one accepted international peer-reviewed publication; must have given 2 seminars; must have actively participated at an international conference; must have followed an equivalent of 6 ECTS credits (of which at least 2 must be dedicated to transferable skills); must have contributed to bachelor or master education. These are the minimum requirements for completion of the doctoral training programme.		Around 90% of the PhD researchers finally continue in a non-academic environment (e.g. Industry, government, etc.)
Denmark	<ol style="list-style-type: none"> 1) conduct research at international level. 2) conduct development at international level. 3) be able to disseminate research results or perform teaching. 4) work independently on a research topic. 5) publish international scientific papers. 	Yes, in the ministerial order for PhD education: http://btfy.me/ty9c4d .	<ol style="list-style-type: none"> a) science: 50%; b) commerce and industry: 40%; c) administration: 10%.

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<p>Turkey</p>	<p>1.to be able to make use of new information in their field by deploying a systematic approach. 2.to be able to develop a new idea, method, design and/or application that's an innovation to their field, or to be able to apply a known idea, method, design and/or application to a different field, to be able to research an original topic, to grasp, to design, adapt and apply. 3.to be able to do critical analysis, synthesis and evaluation of new and complex ideas. 4.to have gained highest level of skills in using research methods in work. That competencies include: 1.to work and take responsibility independently. 2.to learn 3.communication and social competency 4.field-specific competencies</p>	<p>These are defined in a national framework by Turkey's Council of Higher Education. Unfortunately the link is in Turkish (page 31 on https://bologna.yok.gov.tr/files/1fd58513c8ad79fe43ca1b7c1adc4a8b.pdf)</p>	<p>a) 10 % b) 80% c) 10 %</p>
<p>United Kingdom</p>	<p>The creation and interpretation of new knowledge through original research or other advanced scholarship of a quality to satisfy peer review, extend the forefront of the discipline and merit publication</p>	<p>QAA The UK Doctorate www.vitae.ac.uk/</p>	<p>industry: 65% education: 35%</p>

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Italy	<ol style="list-style-type: none"> 1) wide scientific background and deep insight in specific field 2) attitude to innovation & research ambitions 3) attitude to learn work, also in international environment 4) trans-disciplinary and inter-disciplinary 5) communicative skills 	Yes.	a) 10% b) 60% c) 30%
France	<p>These points were really discussed in the frame of EAEEIE projects. We have defined about 10 major skills and competences. It is difficult to establish a ranking. However, for the supervisor, the major points are the quality of the research work and the scientific production.</p>	Not really.	About 1/3, 1/3, 1/3
Portugal	<ol style="list-style-type: none"> 1. Ability to systematically understand a scientific domain; 2. Competencies, skills and research methods associated with a scientific field; 3. Be able to critically analyze, evaluate and synthesise new and complex ideas; 4. Be able to communicate with their peers, the academic community and society at large on the area of specialization; 5. Ability to conceive, design, adapt and perform significant research respecting the requirements imposed by the standards of academic quality and integrity. 	<p>National framework. http://dre.pt/pdf1sdip/2013/08/15100/0474904772.pdf (in portuguese only)</p>	<ol style="list-style-type: none"> a) science - 95% (including higher education intitutions) b) commerce and industry - 4% c) governmental organizations and administration - 1%

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<p>Poland</p>	<p>Three skills expected upon completion of the doctoral phase are defined: 1. professional skills, 2. knowledge, 3. social skills.</p>	<p>The expected skills and competences are defined in the National Learning Outcomes Framework, following the EQF guidelines, and finally accepted by the university Senate.</p>	<p>Estimated percentage of consecutive occupation of the candidates after doctorate: a) science 70%; b) commerce and industry 20%; c) governmental organizations and administration 10%</p>
<p>Spain</p>	<p>1) be able to disseminate research results. 2) work independently on a research topic. 3) publish international scientific papers.</p>		<p>80-10-10</p>

(Outcome; ctd.)

Country	4. Is the successful doctorate a formal prerequisite for a consecutive university career?	5. Which key issues are under discussion in your country concerning the outcome and personal profile after completion of the doctorate?	6. What is likely to change in future?
Germany	Yes.	The engineering doctorate and its outcomes are well established and well reputed by German industry, commerce, and administration. There are mainly two points to be discussed: duration of the doctorate, and establishment of formal quality control, e.g. concerning prevention	
Netherlands	in practice yes	balance between knowledge, skills and personal stature	more attention for professional skills and orientation on career after the PhD
Belgium	In order to continue as a professor, one must have obtained a PhD.	Not really under discussion, but there is movement: There has been increasing attention over the past 4-5 years to the profile of PhD researchers, with regard to personal skills development and career development. The doctoral training has been developing and now includes a much wider variety of courses and trainings, in order to give PhD researchers the opportunity to develop them selves as professional researchers in an academic as well as a non-academic career after the PhD;	

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Denmark	A PhD degree is a formal requirement for any academic research position. Also an unconditional requirement for entering junior academic positions such as postdoc or assistant professor positions.	Denmark has increased the education of PhD level candidates significantly in recent years and it is a key issue that most get employed in industry. Therefore, employment place and rate are important factors.	Unclear.
Turkey	Yes, for the academic track starting with assistant professor up to full professor.	Disciplinary boundaries; PhDs being pigeon holed versus being able to establish ties in an interdisciplinary fashion.	The industry, as the country advances to get past the status of a technology importer to become a producer and exporter, finds it needs more PhDs in engineering.
United Kingdom	PhD normally required for Universities		
Italy	Yes.	Employability by the industry	
France	Yes.	The main discussion concerns academic positions; some insitutions would like to recruit no doctor members.	The use of LLL (and APPEL) . If good researchers are not doctors, they can obtain in a short time a PhD.
Portugal	Yes.	a) the profile must be exclusively scientific? b) wich outcomes should be emphasized to allow an increase of doctorates in industry?	Possible change in the outcome and personal profile
Poland	The successful doctorate is a formal prerequisite for a consecutive university career	Increasing number of doctoral students is the top priority in Poland and it is supported by comprehensive grant program.	
Spain	Yes	Appreciation by the industry	